

## Claims

- [c1] 1. A method of removing harmful gases from an automobile exhaust containing  $\text{NO}_x$ , CO, and hydrocarbons the method comprising:  
contacting a  $\text{NO}_x$  trap composition with a first exhaust gas mixture at a temperature of at least 200°C, the first exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-lean condition and the  $\text{NO}_x$  trap composition comprising:  
a precious metal;  
a  $\text{NO}_x$  absorber material;  
an oxide that inhibits the decrease in  $\text{NO}_x$  storing ability of the  $\text{NO}_x$  trap composition; and  
a support material; and  
contacting the  $\text{NO}_x$  trap composition with a second exhaust gas composition at a temperature of at least 200°C, the second exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-rich condition.
- [c2] 2. The method of claim 1 wherein the oxide that inhibits the decrease in  $\text{NO}_x$  storing ability of the  $\text{NO}_x$  trap composition is selected from the group consisting of oxides

of magnesium, oxides of manganese, and combinations thereof.

- [c3] 3. The method of claim 1 wherein the oxide that inhibits the decrease in NO<sub>x</sub> storing ability of the NO<sub>x</sub> trap composition is present in an amount from about 1 to 30% of the total weight of the NO<sub>x</sub> trap washcoat.
- [c4] 4. The method of claim 1 wherein the oxide that inhibits the decrease in NO<sub>x</sub> storing ability of the NO<sub>x</sub> trap composition is present in an amount from about 5 to 20% of the total weight of the NO<sub>x</sub> trap washcoat.
- [c5] 5. The method of claim 1 wherein the oxide that inhibits the decrease in NO<sub>x</sub> storing ability of the NO<sub>x</sub> trap composition is present in an amount from about 5 to 15% of the total weight of the NO<sub>x</sub> trap washcoat.
- [c6] 6. The method of claim 1 wherein the NO<sub>x</sub> absorber is selected from the group consisting of oxides of alkali metals, oxides of alkaline earth metals, oxides of rare earth metals, and combinations thereof.
- [c7] 7. The method of claim 1 wherein the NO<sub>x</sub> absorber is selected from the group consisting of cesium oxide, praseodymium oxide, strontium oxide, barium oxide, and combinations thereof.

- [c8] 8. The method of claim 1 wherein the precious metal is a metal selected from the group consisting of platinum, palladium, rhodium, and combinations thereof.
- [c9] 9. The method of claim 1 wherein the NO<sub>x</sub> trap composition is applied to a substrate.
- [c10] 10. The method of claim 9 wherein the substrate is cordierite.
- [c11] 11. The method of claim 9 wherein the NO<sub>x</sub> trap composition is applied to the substrate by washcoating.
- [c12] 12. A vehicle exhaust system implementing the method of claim 1.
- [c13] 13. A thermally stable NO<sub>x</sub> trap composition comprising:
  - a support material;
  - a NO<sub>x</sub> absorber material;
  - an oxide selected from the group consisting of oxides of magnesium, oxides of manganese, and combinations thereof in sufficient contact with the NO<sub>x</sub> absorber that a NO<sub>x</sub> trap incorporating the NO<sub>x</sub> trap composition has a NO<sub>x</sub> storage efficiency of at least 5% at a temperature of 400°C after aging of the NO<sub>x</sub> trap; and
  - a precious metal in contact with the NO<sub>x</sub> material.
- [c14] 14. The composition of claim 13 wherein the NO<sub>x</sub> ab-

sorber is selected from the group consisting of oxides of alkali metals, oxides of alkaline earth metals, oxides of rare earth metals, and combinations thereof.

- [c15] 15. The composition of claim 13 wherein the NO<sub>x</sub> ab-sorber is selected from the group consisting of cesium oxide, praseodymium oxide, strontium, barium oxide, and combinations thereof.
- [c16] 16. The composition of claim 13 wherein the precious metal is a metal selected from the group consisting of platinum, palladium, rhodium, and combinations thereof.
- [c17] 17. The composition of claim 13 wherein the oxide is present in an amount from about 1 to 30% of the total weight of the NO<sub>x</sub> trap washcoat.
- [c18] 18. The composition of claim 13 applied to a substrate.
- [c19] 19. The composition of claim 18 wherein the substrate is cordierite.
- [c20] 20. A vehicle exhaust system comprising a NO<sub>x</sub> trap that includes the composition of claim 13.
- [c21] 21. A method of removing harmful gases from an automobile exhaust containing NO<sub>x</sub>, CO, and hydrocarbons the method comprising:

contacting a  $\text{NO}_x$  trap composition with a first exhaust gas mixture at a temperature of at least 200°C, the first exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-lean condition and the  $\text{NO}_x$  trap composition comprising:

- a precious metal;
- barium oxide;
- a oxide that inhibits the decrease in  $\text{NO}_x$  storing ability of the barium oxide; and
- a support material; and

contacting the  $\text{NO}_x$  trap composition with a second exhaust gas composition, the second exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-rich condition.